

Experimental Design

- 1) Define the following
 - a. Control Group
 - b. Placebo
 - c. Single-Blind
 - d. Double-Blind
 - e. Experimental Unit
- 2) The article “Placebos Are Getting More Effective. Drug Makers Are Desperate to Know Why” states that “according to research, the color of a tablet can boost the effectiveness even of genuine meds—or help convince a patient that a placebo is a potent remedy.” Describe how you would design an experiment to investigate if adding color to Tylenol tablets would result in greater perceived pain relief. Be sure to address how you would select subjects, how you would measure pain relief, what colors you would use, and whether or not you would include a control group in your experiment.
- 3) A novel alternative medical treatment for heart attacks seeds the damaged heart muscle with cells from the patient’s thigh muscle. Doctor Dib from the Arizona Heart Institute evaluated the approach on 16 patients with severe heart failure. The article states that “ordinarily, the heart pushes out more than half its blood with each beat. Dib’s patients had such severe heart failure that their hearts pumped just 23 percent. After bypass surgery and cell injections, this improved to 36 percent, although it was impossible to say how much, if any, of the strength resulted from the extra cells.”
 - a. Explain why it is not reasonable to generalize to the population of all heart attack victims based on the data from these 16 patients.
 - b. Explain why it is not possible to say whether any of the observed improvement was due to the cell injections, based on the results of the study.
 - c. Describe a design for an experiment that would allow researchers to determine whether bypass surgery plus cell injections was more effective than bypass surgery alone.
- 4) The article “Doctor Dogs Diagnose Cancer by Sniffing It Out” reports the results of an experiment described in the journal *Integrative Cancer Therapies*. In this experiment, dogs were trained to distinguish between people with breast and lung cancer and people without cancer by sniffing exhaled breath. Dogs were trained to lay down if they detected cancer in a breath sample. After training, dogs’ ability to detect cancer was tested using breath samples from people whose breath had not been used in training the dogs. The paper states “The researchers blinded both the dog handlers and the experimental observers to the identity of the breath samples.” Explain why this blinding is an important aspect of the design of this experiment.
- 5) Pismo Beach, California, has an annual clam festival that includes a clam chowder contest. Judges rate clam chowders from local restaurants, and the judging is done in such a way that the judges are not aware of which chowder is from which restaurant. One year, much to the dismay of the seafood restaurants on the waterfront, Denny’s chowder was declared the winner! (When asked what the ingredients were, the cook at Denny’s said he wasn’t sure—he just had

to add the right amount of nondairy creamer to the soup stock that he got from Denny's distribution center!)

- a. Do you think that Denny's chowder would have won the contest if the judging had not been "blind?" Explain.
 - b. Although this was not an experiment, your answer to Part (a) helps to explain why those measuring the response in an experiment are often blinded. Using your answer in Part (a), explain why experiments are often blinded in this way.
- 6) The article "A Debate in the Dentist's Chair" described an ongoing debate over whether newer resin fillings are a better alternative to the more traditional silver amalgam fillings. Because amalgam fillings contain mercury, there is concern that they could be mildly toxic and prove to be a health risk to those with some types of immune and kidney disorders. One experiment described in the article used sheep as subjects and reported that sheep treated with amalgam fillings had impaired kidney function.
 - a. In the experiment, a control group of sheep that received no fillings was used by there was no placebo group. Explain why it is not necessary to have a placebo group in this experiment.
 - b. The experiment compared only amalgam filling treatment group to a control group. What would be the benefit of also including a resin filling treatment group in the experiment?
 - c. Why do you think the experimenters used sheep rather than human subjects?